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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : *Kazmer* et al.
Serial No.: 09/578,108
Filed : May 24, 2000
Title : PERFORMANCE-BASED REPRESENTATION FOR SUPPORT OF MULTIPLE DECISIONS

Art Unit : 2762
Examiner : Javid A. Amini

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

BRIEF ON APPEAL

(1) Real Party in Interest

The real party in interest is the University of Massachusetts, a Massachusetts corporation having a place of business at One Beacon Street, Boston Massachusetts as evidenced by an assignment executed June 30, 2000 and recorded on September 1, 2000 at reel 011081 frame 0281.

(2) Related Appeals and Interferences

Neither Applicant, nor Applicant's legal representative, nor the assignee are aware of any appeals or interferences that will directly affect or be affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

Applicant filed the present application on May 24, 2000 with claims 1-39. Of these, claims 1, 14 and 27 are independent.

CERTIFICATE OF MAILING BY FIRST CLASS MAIL

I hereby certify under 37 CFR §1.8(a) that this correspondence is being deposited with the United States Postal Service as first class mail with sufficient postage on the date indicated below and is addressed to the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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Typed or Printed Name of Person Signing Certificate

Claims 1-3, 5-8, 11, 14-21, 24, 27-34, and 37 stand rejected under 35 USC 103 as being rendered obvious by *Sugino*.

Claims 4, 9-10, 12-13, 22-23, 25-26, 35-36, and 38-39 stand rejected under 35 USC 103 as being rendered obvious by *Sugino* and *Daniel*.

Claims 1-39 stand rejected under 35 USC 112 as being indefinite.

Claims 14-26 are subject to a double-patenting rejection.

On August 12, 2003, Applicant appealed from the rejection. A copy of the claims pending in this appeal is attached as Appendix I.

No claims have been cancelled. Accordingly, claims 1-39 are pending and on appeal.

(4) Status of Amendments

An amendment to claim 33 to delete an extraneous comma was entered following Applicant's reply to the first office action. At a personal interview and demonstration on November 18, 2003, an amendment was proposed that the Examiner and the Supervisory Examiner indicated would place the claims in condition for allowance. This amendment was formally submitted in a response to the final office action filed on December 2, 2003. Contrary to their positions taken at the November 18, 2003 interview and demonstration, the examiners returned an advisory action indicating that the proposed amendment would require further search. The amendment was not entered.

(5) Summary of Invention

The invention provider a graphical-user interface to assist a system designer in the solution of multivariate optimization problems.

In designing a system, there are often several parameters whose values the designer can select. These are referred to in the specification as "design variables." Mathematically, they can be viewed as the independent variables $x_1, x_2, \ldots x_n$. These design variables $(x_1, x_2, \ldots x_n)$ are used to control values of "performance attributes," which can be viewed mathematically as the dependent variables $y_1, y_2, \ldots y_m$.

The designer's role is to choose the independent variables $x_1, x_2...x_n$ such that each of the dependent variables $y_1, y_2, ...y_m$ falls within a corresponding range of values. The designer does so subject to constraints on the values of each of the independent variables.

In many cases, the existence of constraints on values of the independent variables means that those values cannot be chosen independently. As just one example, if an article is constrained to be below a certain weight limit, one cannot just increase its length without also decreasing its width. Similarly, there will be times when the value of a dependent variable depends not only on the values of the independent variables but also on the values of other dependent variables.

A difficulty faced by the designer is that of developing an intuitive sense of how to manipulate the x_i in such a way that: (1) all the x_i remain within their constraints, and (2) all the y_i fall within their target ranges. The designer is in many cases hampered by an inability to visualize the multi-dimensional spaces in which he operates. The invention is directed to providing a way for the designer to visualize these multi-dimensional spaces.

The invention provides a display that simultaneously presents three types of graphs. These are:

1. "Control graphs" that show an dependent variable as a function of an independent variable (i.e., x_i v. y_j).
2. "Performance graphs" that show a dependent variable as a function of *another* dependent variable (i.e., y_i v. y_j).
3. "Decision graphs" that show an independent variable as a function of *another* independent variable (i.e. x_i v. x_j).

A "design-interface" associated with the display enables the designer to change the value of any one of the x_i and to quickly visualize the effects of doing so, both on the x_i and on the y_i.

(6) Issues

1. Whether claims 1-3, 5-8, 11, 14-21, 24, 27-34, and 37 are obvious in view of *Sugino*.

2. Whether claims 1-39 are indefinite under 35 USC 112.

3. Whether the double-patenting rejection of claims 14-26 is proper.

(7) Grouping of Claims

Claims 1-39 stand or fall together.

(8) Argument

DOUBLE-PATENTING REJECTION

Claims 14-26 are subject to a double-patenting rejection in view of claims 27-39. The Examiner's remarks, however, refer to an objection under 37 CFR 1.75. It is unclear to Applicant whether the Examiner considers this to be a double-patenting rejection subject to appeal or an objection subject only to petition.

In an interview on June 25, 2003, the Examiner agreed to withdraw this rejection/objection, thereby rendering this ambiguity moot. However, to date, no written confirmation of such withdrawal has been provided. Accordingly, Applicant is compelled to address this issue on appeal.

A double-patenting rejection of a claim is proper when an issued patent has a claim that is identical to the pending claim, or when an issued patent has a claim that is but an obvious variation of the pending claim.

In this case, the Examiner has not drawn attention to any issued patent. Instead, the Examiner has stated that claims 14-26 and claims 27-39 are substantial duplicates of each other. Whether or not this is true is irrelevant to a double-patenting rejection because a double-patenting rejection requires an issued patent.

Moreover, claims 14-26 and claims 27-39 are not substantial duplicates of each other. In fact, they belong to different statutory classes. Claims 14-26 are method claims, whereas claims 27-39 are directed to an article of manufacture.

Accordingly, to the extent that the Board considers the Examiner to have made a double-patenting rejection, Applicant requests that the Board reverse that rejection.

SECTION 112 REJECTIONS

In a telephone interview on June 25, 2003, the Examiner agreed to withdraw the section 112 rejection of claim 1. In a personal interview and demonstration attended by the Examiner, the Supervisory Examiner, the inventor, and the attorney-of-record, the Examiner agreed to withdraw all the remaining section 112 rejections except that of claim 5 and claim 11.

Despite repeated requests, Applicant has not received written confirmation of the withdrawal of any of the section 112 rejections. Accordingly, Applicant is compelled to address these rejections on appeal.

SECTION 112 REJECTION OF CLAIM 1

There exists antecedent basis for "processor"

Claim 1 stands rejected under 35 USC 112 because there is allegedly insufficient antecedent basis for the recitation of a "processor."[1]

Applicant draws attention to the discussion on pages 17-18 of the specification concerning the hardware for implementing the invention. In particular, beginning on the last line on page 17, the specification states that:

> "The instructions can be executed on a general purpose digital computer having a processor, a keyboard and/or mouse for communicating with a designer, and an output device, such as a video display monitor."

Applicant submits that this provides sufficient antecedent basis for "processor."

There exists antecedent basis for "control graphs"

Claim 1 also stands rejected under 35 USC 112 because there is allegedly insufficient antecedent basis for the limitation:[2]

> "a plurality of control graphs...at least one of said control graphs illustrating an effect of a first design variable on a first performance attribute."

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[1] *Final office action*, page 11, point 2.
[2] *Final office action*, page 11, point 3.

According to the Examiner, the claim allegedly

> "dose [sic] not specify the number of control graphs that shows which one of control graphs illustrating an effect of a first design variable on a first performance attribute."

As a threshold matter, a claim is not required to recite a *specific number* of control graphs unless such a number is required to distinguish over the prior art.

For antecedent basis, Applicant draws attention to the discussion of FIGS. 10 and 14 in the specification. In particular, FIG. 10 shows control graphs that collectively relate four design variables (height, width, mid-thickness, and bottom thickness) and three performance attributes (stress, vertical deflection, cross-area). Since there are four design variables and three performance attributes, there are twelve control graphs. In addition, the term "control graph" is introduced into the specification beginning on the last line of page 1. Applicant asserts that one of ordinary skill in the art who reads the text and figures will recognize the meaning of the term "control graph" in the claims.

Applicant has difficulty understanding the further comment in point 3 concerning specifying the number of control graphs. In an effort to explain claim 1, Applicant provides the following example of how claim 1 may be interpreted in the context of FIG. 10.

Within the context of FIG. 10, the limitation of "at least one...control graph" could be read on the upper leftmost control graph, in which case the "first design variable" would be "height" and the "first performance attribute" would be "cross-area." However, the "at least one control graph" can also just as easily read on the bottom leftmost control graph, in which case the "first performance attribute" becomes "stress" and the first design attribute becomes "height."

It may be useful, in better understanding the invention, to note that the various graphs shown in FIG. 10 and 14 correspond to the schematic diagram shown in FIG. 1. The control graphs discussed above correspond to the region designated "Function Matrix" in FIG. 1. The performance graphs and the decision graphs, both of which are discussed in more detail below, are in the regions designated "Performance Space" and "Decision Space" respectively in FIG. 1.

There exists antecedent basis for "performance graphs"

Claim 1 also stands rejected under 35 USC 112 because of an alleged lack of insufficient antecedent basis for the limitation

> "a plurality of performance graphs...at least one of said performance graphs showing a relationship between said first performance attribute and a second performance attribute"[3]

because the claim

> "dose [sic] not specify the number of performance graphs that shows which one of performance graphs showing a relationship between first performance attribute and a second performance attribute."

Again, it is unclear why a specific number of performance graphs must be recited in the claim absent prior art that compels such recitation.

In addition, Applicant draws attention to the discussions of performance graphs in the specification, for example in connection with FIGS. 10 and 14. In particular, FIG. 10 shows performance graphs that collectively relate any two of the three performance attributes (stress, vertical deflection, cross area) to each other. Since there are three ways to combine three performance attributes two at a time, there are three performance graphs.

In addition, the term "performance graph" is introduced into the specification beginning on page 2, line 2. Applicant asserts that one of ordinary skill in the art who reads the text and figures will recognize the meaning of the term "performance graph" in the claims.

Applicant has difficulty understanding the further comment in point 4 concerning specifying the number of performance graphs. In an effort to explain claim 1, Applicant provides the following example of how claim 1 may be interpreted in the context of FIG. 10.

FIG. 10 shows three performance graphs arranged in a triangle to the left of the twelve control graphs. Within the context of FIG. 10, the limitation of "at least one...performance graph" could be read on the topmost performance graph, in which case the "first performance attribute" would be "cross area" and the "second performance attribute" would be "vertical

[3] Final Office Action, page 11, point 4.

deflection." However, the "at least one performance graph" can just as easily read on the bottom performance graph, in which case the "first performance attribute" becomes "stress" and the second design attribute becomes "Vertical deflection."

There exists antecedent basis for "decision graphs"

Claim 1 also stands rejected under 35 USC 112 because there is allegedly insufficient antecedent basis for the limitation

> "a plurality of decision graphs...at least one of said decision graphs showing a relationship between said first design variable and a second design variable"

because the claim

> "dose [sic] not specify the number of decision graphs that shows which one of decision graphs showing a relationship between first design variable and a second design variable."[4]

Applicant respectfully draws attention to the discussion of decision graphs in the specification, for example in connection with FIGS. 10 and 14. In particular, FIG. 10 shows decision graphs that collectively relate any two of the four design variables (height, width, mid thickness, bottom thickness) to each other. Since there are six ways to combine four design variables two at a time, there are six decision graphs shown in FIG. 10. These six decision graphs are arrayed in a triangle above the twelve control graphs.

In addition, the term "decision graph" is introduced into the specification beginning on page 2, line 2. Applicant asserts that one of ordinary skill in the art who reads the text and figures will recognize the meaning of the term "decision graph" in the claims.

Applicant has difficulty understanding the comment concerning specifying the number of decision graphs. In an effort to explain claim 1, Applicant provides the following example of how claim 1 may be interpreted in the context of FIG. 10.

Within the context of FIG. 10, the limitation of "at least one decision graph" could be read on the topmost decision graph, in which case the "first design variable" would be "height"

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[4] *Final office action*, page 12, point 5.

and the "second design variable" would be "bottom thickness." However, the "at least one decision graph" can just as easily read on the bottom leftmost decision graph, in which case the "first design variable" becomes "height" and the second design attribute becomes "width."

There exists antecedent basis for "design interface"

Claim 1 stands rejected under 35 USC 112 because there is allegedly insufficient antecedent basis for the limitation

> a design-interface coupled to said input of said processor, said design-interface enabling a user to manipulate said first design variable to control said first performance attribute.[5]

Applicant draws attention to discussions of the design interface found in the specification. For example, a design interface is discussed in the following passage:

> "The computer-implemented display also includes a *design interface* though [sic] which the designer interactively manipulates values of the design variables so as to control the performance attributes. Because of its intuitive nature, the *design interface* preferably includes an adjustable slider or scroll box in which movement of the scroll box or slider changes the value of the design variable. Alternatively, or in addition to the adjustable slider or scroll box, the *design interface* can include a text box or field into which the designer can enter a numerical value for the design variable. The text box or field is particularly useful when the value of a design variable needs to be changed by an amount that would require infinitesimal motion of the slider."[6][emphasis supplied]

In the illustrated embodiment, the coupling of the design interface to the processor is thus a coupling of the same type as that used when manipulating graphical elements on a display or otherwise entering data on a display. However, the exact nature of the coupling is not of particular significance in defining the invention.

Applicant has identified antecedent basis for each term that the Examiner considers to be lacking in antecedent basis. There are no further grounds for rejecting claim 1 under 35 USC 112. Accordingly, Applicant requests that the Examiner's 35 USC 112 rejection of claim 1 be reversed.

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[5] *Final office action*, page 12, point 6.

[6] *Applicant's specification*, page 2, lines 12-20.

SECTION 112 REJECTION OF CLAIMS 2-4

Claims 2-4 are rejected under 35 USC 112 for the same reason given for claim 1.[7] Accordingly, Applicant submits that the rejection of claims 2-4 is improper for at least the same reasons as discussed above in connection with claim 1.

SECTION 112 REJECTION OF CLAIM 5

Claim 5 stands rejected under 35 USC 112 because the terms "random variable" and "probability distribution" are allegedly unclear.[8]

According to the MPEP, "[a] claim is indefinite when it contains terms whose meanings are unclear."[9]

Applicant submits that "random variable" and "probability distribution" are well-known terms from probability theory. In responding to the first office action, Applicant submitted, for the Examiner's consideration, extrinsic evidence in the form of pages copied from a technical dictionary. These pages provide definitions for both of these terms.

Applicant submits that the notoriety of the terms "random variable" and "probability distribution" in the art precludes a rejection under 35 USC 112. Accordingly, Applicant requests that the section 112 rejection of claim 5 be reversed.

SECTION 112 REJECTION OF CLAIMS 6-7 AND CLAIM 10

Claim 6 stands rejected under 35 USC 112 because the term "permissible values" allegedly lacks antecedent basis.[10] Claim 10 stands rejected under 35 USC 112 because the term "weight" allegedly lacks antecedent basis.[11]

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[7] *Final office action* page 12, point 7.
[8] *Final office action*, page 12, point 8.
[9] *MPEP* 2173.05(e).
[10] *Final office action*, page 13, point 9.
[11] *Final office action*, page 13, point 10.

Applicant draws attention to page 8, lines 13-14 in which the specification states that:

> "a designer can apply a weighting coefficient for different performance attributes"[emphasis supplied]

With regard to the term "permissible values", Applicant draws attention the specification's use of the word "value" in the context of performance attributes in the first paragraph of the "Background" section on page 1:

> "The engineering design process can be viewed as the process of attaining specified *values of one or more performance attributes* by manipulating one or more design variables within limits specified by one or more corresponding constraints."[emphasis supplied]

Applicant submits that the adjective "permissible" has a common English meaning. In responding to the first office action, Applicant submitted extrinsic evidence in the form of a dictionary definition from Webster's Ninth New Collegiate Dictionary.

It is not possible to specify a specific range of permissible values. The choice of what values are permissible and what values are not would inevitably depend on the specific design problem being addressed, on the units used to express various quantities, on whether those quantities are normalized or otherwise scaled, and on a host of other factors that have nothing to do with the invention.

SECTION 112 REJECTION OF CLAIM 8

Claim 8 stands rejected under 35 USC 112 for the same reasons as claim 6, a claim from which claim 8 depends.[12]

Applicant requests reversal of this rejection for the same reasons set forth in connection with claim 6.

SECTION 112 REJECTION OF CLAIM 9

Claim 9 stands rejected under 35 USC 112 because the term "array" allegedly lacks antecedent basis in the specification.[13]

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[12] *Final office action*, page 13, point 11

Applicant draws attention to FIGS. 10 and 14, both of which plainly show an array of control graphs . In particular, FIG. 10 shows a 3×4 array of control graphs and FIG. 14 shows a 2×4 array of control graphs. In addition, on page 2, lines 4-6, the specification states that

> "[f]or ease of visualization *the control graphs are arranged to form an array* in which each row is associated with a performance attribute and each column is associated with a decision variable." [emphasis supplied]

SECTION 112 REJECTION OF CLAIM 10

Claim 10 stands rejected under 35 USC 112 for the same reasons as claim 9, the claim from which it depends.[14]

Applicant requests reversal of the rejection for the same reasons set forth in connection with claim 9.

SECTION 112 REJECTION OF CLAIM 11

Claim 11 stands rejected under 35 USC 112 because the term "allowable values" allegedly lacks antecedent basis.[15]

Applicant draws attention to the specification's use of the term "allowed range of values" on page 2, lines 9-11:

> "Optionally, to assist a designer in visualizing the constraints on the design, *the decision graph shows the allowed range of values for both design variables.*" [emphasis supplied]

SECTION 112 REJECTION OF CLAIM 12

Claim 12 stands rejected under 35 USC 112 for the same reasons as claims 9 and 1.[16]

Applicant requests reversal of this rejection for the same reasons set forth above in connection with claims 9 and 1.

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[13] *Final office action*, page 13, point 12
[14] *Final office action*, page 13, point 13.
[15] *Final office action*, page 13, point 14.
[16] *Final office action*, page 13, point 15.

SECTION 112 REJECTION OF CLAIM 13

Claim 13 stands rejected under 35 USC 112 because the term "Pareto optimal" is allegedly unclear.[17]

Applicant submits that the term "Pareto optimal" is well known in arts such as mathematical programming, optimization theory, and operations research.

Moreover, Applicant's specification also includes the following brief discussion of Pareto optimality on page 8, lines 18-26:

> "The method and system of the invention are extensible to *m* performance attributes and *n* design parameters. Let the performance attributes $Y^* = \{y_1^*, y_2^*, ..., y_m^*\} \in S$, where S is the total performance space, $\{Y \in R^m \mid LSL \le Y \le USL, LCL \le X \le UCL, Y=f(X)\}$. Y* is defined as Pareto optimal (non-inferior) if and only if there exists no other $Y'=(y_1', y_2', ..., y_m') \in S$, where $Y' \neq Y^*$,such that $y_j' \le y_j^* \; \forall j$ (without loss of generality, the smaller value of the performances is assumed to be better). Therefore, the boundary BCD of FIG. 5 is the Pareto Optimal set. Any element in the Pareto Optimal set represents one "optimal" design vector. The term "optimal" here means that there is no way to improve the performance of one attribute without causing a decrease in the performance attribute."

Since the meaning of "Pareto optimal" is well known in the art, and since the term is also defined in the specification, Applicant requests reconsideration and withdrawal of this rejection.[18]

SECTION 112 REJECTION OF CLAIM 14-39

Claims 14-39 stand rejected under 35 USC 112 for the same reasons set forth for claims 1-13.[19]

Applicant requests reversal of these rejections for the same reasons set forth above in connection with claims 1-13.

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[17] *Final office action*, page 13, point 16.

[18] *MPEP* 2173.05(a) ("The meaning of every term used in a claims should be apparent from the prior art or from the specification and drawings at the time the application is filed").

[19] *Final office action*, page 13, points 17-18

SECTION 103 REJECTION BASED ON SUGINO

Clams 1-3, 5-8, 11, 14-21, 24, 27-34, and 37 all stand rejected as being rendered obvious by *Sugino*. Applicant proposes to discuss only claim 1 in detail, since the remaining claims include the limitations of claim 1 and are therefore allowable for at least the same reasons that claim 1 is allowable.

Claim 1 stands rejected as being rendered obvious by *Sugino*, a reference first identified by the USPTO as being of general interest in an international search report for a corresponding PCT application.

According to the present Examiners, *Sugino* teaches every element of the claimed invention with the exception of the "design-interface."

It appears that the Examiners have identified certain graphs in *Sugino* as being performance graphs, certain other graphs as being decision graphs, and certain other graphs as being control graphs. It is not clear from the office actions received thus far precisely which graphs in *Sugino* the Examiner considers to correspond to each one of these types of graphs.

As a threshold matter, the mere fact that a patent application happens to show several graphs does not mean that any of these graphs are actually "generated *on said display*" as recited in claim 1. In fact, there is no indication anywhere in *Sugino* that these graphs are anything but illustrative drawings intended to assist the reader in understanding the subject matter of the *Sugino* invention.

Since it is unclear precisely what graphs in *Sugino* correspond to each of the graph types in claim 1, Applicant must proceed methodically through each graph shown in *Sugino* to determine what it might correspond to in claim 1. In doing so, it is helpful to note that as used in Applicant's specification and claims, "decision variables" are those variables whose values the designer specifies directly, and "performance attributes" are variables whose values are controlled by the decision variables.

FIG. 5

FIG. 5 of *Sugino* shows a graph in which a quantity referred to as "chip pad" is plotted against "chip pad position." The graph shows three points, each connected by a line to a drawing of what appears to be a flat plate, or "chip pad" within a chamber. Varying amounts of a resin are shown above and below the three chip pads.

In comparing the graph to the three drawings above it, it is clear that "chip pad position" refers to the height of the chip pad above the floor of the chamber. The variable "chip pad" appears to measure the extent to which the amount of resin on one side of the chip pad differs from the amount of resin on the other side of the chip pad. This interpretation is borne out by the fact that the minimum value of "chip pad" is associated with a figure in which the amount of resin above and below the flat plate is equal.

In FIG. 5, the "decision variable" is clearly the chip pad position.[20] Depending on the value of the chip pad position, the ratio of resin above and below the flat plate changes. This ratio, which corresponds to the quantity "chip pad," is therefore a "performance attribute."

Since FIG. 5 has one axis that is a design variable and one axis that is a performance attribute, it can be none other than a "control graph" within the meaning of claim 1.

Because "chip pad" is a performance attribute, FIG. 5 cannot possibly be considered a "decision graph" According to claim 1, a "decision graph" would have to have *both* axes corresponding to "design variables." In FIG. 5, only *one* axis ("chip pad position") corresponds to a design variable. The other ("chip pad") corresponds to a performance attribute.

Conversely, because "chip pad position" is a design variable, FIG. 5 cannot possibly be considered a "performance graph." According to claim 1, a "performance graph" would have to have *both* axes corresponding to "performance attributes." In FIG. 5, only *one* axis ("chip pad") corresponds to a performance attribute. The other ("chip pad position") corresponds to a design variable.

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[20] *Sugino*, col. 6, lines 31-59 refer to "chip pad position" as being a quantity that the designer provides.

FIG. 6

The only difference between FIGS. 5 and 6 is that in FIG. 6, "chip pad" is replaced by "stress during reflow soldering." This stress is likewise controlled by the value of "chip pad position." When "chip pad position" is small, there is a great deal of stress because the chip pad must support the weight of a great deal of resin above it. Conversely, when "chip pad position" is large, the chip pad supports the weight of only a small amount of resin above it.

FIG. 6 is therefore another control graph, just like FIG. 5. It cannot be considered a decision graph or a performance graph.

FIG. 7 shows only control graphs

The horizontal axis of each graph shown in FIG. 7 is either a decision variable (i.e. "chip pad position") or a normalized decision variable (i.e. x), which would still amount to a decision variable. Since by definition a performance graph must have *both* of its axes be performance attributes, none of the graphs in FIG. 7 qualifies as a performance graph.

The vertical axis of each graph shown in FIG. 7 is either a performance attribute (i.e. "chip pad" or "stress reflow") or a quantity derived from one or more performance attributes (i.e. $f1, f2, F(x)$), which would still correspond to a performance attribute. Since by definition a decision graph must have *both* of its axes be design variables, none of the graphs in FIG. 7 qualifies as a decision graph.

Therefore, by elimination, all graphs shown in FIG. 7 must be "control graphs" within the meaning of claim 1.

FIG. 8

The left side of FIG. 8 shows graphs that are like those discussed in FIG. 7. These graphs are control graphs for the same reasons already discussed in connection with FIG. 7.

The central portion of FIG. 8 shows a graph representative of data stored in a database.[21] This graph shows a performance attribute on its horizontal axis and a quantity called "defect

[21] *Sugino*, col. 8, lines 5-17.

ratio" on its vertical axis. It is unclear from the description what type of graph this is. However, there is no indication that this graph is ever generated on a display. It appears that this graph is simply illustrative of a procedure used for normalizing performance attributes on the basis of data in a database.

FIG. 9

FIG. 9 shows graphs in which the horizontal axis is a normalized decision variable (x) and the vertical axis is derived from a performance attribute ($DG(x)$ and $f(x)$). These graphs are therefore control graphs because a control graph is one that shows a design variable against a performance attribute.

FIG. 10

FIG. 10 shows essentially the same graphs as shown in FIG. 7. These graphs are control graphs for the same reasons set forth in connection with FIG. 7.

FIGS. 4A-4D

FIGS. 4A-D each show a graph in which the horizontal axis is "chip pad position." As discussed in connection with FIG. 5, "chip pad position" is a design variable. The vertical axis of each graph shows both "chip pad upper stress" and "chip pad lower stress." Both of these are *performance attributes*. Hence. FIGS. 4A-D are all control graphs that happen to show two, rather than one, performance attribute on the same axis.

Summary

Sugino fails to teach or suggest the subject matter for several reasons:

1. There is no teaching or suggestion that any of the graphs presented in FIGS.4-9 of *Sugino* are ever placed on a display as recited in the claim. The graphs in *Sugino* are intended to examples of how the *Sugino* invention works. There is no indication that *Sugino* ever intended them to be displayed to a user on a display screen.

2. *Sugino* fails to teach or suggest the "decision graphs" recited in claim 1.

3. *Sugino* fails to teach or suggest the "performance graphs" recited in claim 1.

Accordingly, Applicant requests reversal of the section 103 rejection of claim 1, 14, 27, and all claims dependent thereon.

The brief fee of $165 is enclosed. Please apply any other charges or credits to Deposit Account No. 06-1050.

Respectfully submitted,

Date: March 4, 2004

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Appendix of Claims

1. (Original) A computer-implemented display system for visualizing the effect of selected values of a plurality of design variables on a plurality of performance attributes, said display system comprising:

a processor having an input for accepting instructions and an output for driving a visual display;

a plurality of control graphs generated on said display using said output of said processor, at least one of said control graphs illustrating an effect of a first design variable on a first performance attribute;

a plurality of performance graphs generated on said display using said output of said processor, at least one of said performance graphs showing a relationship between said first performance attribute and a second performance attribute;

a plurality of decision graphs generated on said display using said output of said processor, at least one of said decision graphs showing a relationship between said first design variable and a second design variable; and

a design-interface coupled to said input of said processor, said design-interface enabling a user to manipulate said first design variable to control said first performance attribute.

2. (Original) The computer-implemented display system of claim 1 wherein said design-interface is a graphical user-interface.

3. (Original) The computer-implemented display system of claim 2 wherein said graphical user-

interface comprises a scroll-bar having a user-adjustable slider and a value of said first design variable changes in response to movement of said adjustable slider.

4. **(Original)** The computer-implemented display system of claim **1** wherein said design-interface comprises a field into which a designer enters a value for said first design variable.

5. **(Original)** The computer-implemented display system of claim **1** wherein said first design variable is a random variable and said design-interface enables a designer to specify a probability distribution of said first design variable.

6. **(Original)** The computer-implemented display system of claim **1** further comprising a specification-interface coupled to said plurality of performance graphs, said specification-interface enabling a designer to specify a range of permissible values for said first performance attribute.

7. **(Original)** The computer-implemented display system of claim **6** wherein said specification-interface further comprises a designer-preference interface for enabling a designer to assign a weight to said first performance attribute, thereby indicating an importance of said first performance attribute relative to said second performance attribute.

8. **(Original)** The computer-implemented display system of claim **6** wherein said first performance attribute is a random variable and said specification-interface enables a user to specify a probability distribution associated with said first performance attribute.

9. **(Original)** The computer-implemented display system of claim **1** wherein said plurality of control graphs is disposed in an array.

10. **(Original)** The computer-implemented display system of claim **9** wherein said array is a rectangular array of rows and columns, each row being associated with a performance attribute and each column being associated with a design variable.

11. (Original) The computer-implemented display system of claim **1** wherein said at least one control graph displays an indication of allowable values of said first design variable.

12. (Original) The computer-implemented display system of claim **1** wherein said at least one performance graph depicts a region of permissible values for said first and second performance attributes.

13. (Original) The computer-implemented display system of claim **12** wherein said region has a boundary representative of a Pareto optimal set of permissible values of said first and second performance attributes.

14. (Original) A method of visualizing the effect of selected values of a plurality of design variables on a plurality of performance attributes, said method comprising:

displaying a plurality of control graphs, at least one of said control graphs illustrating an effect of a first design variable on a first performance attribute;

displaying a plurality of performance graphs, at least one of said performance graphs showing a relationship between said first performance attribute and a second performance attribute;

displaying a plurality of decision graphs, at least one of said decision graphs showing a relationship between said first design variable and a second design variable;

manipulating said first design variable to control said first performance attribute; and

updating said at least one performance graph and said at least one decision graph in response to said manipulation of said first design variable.

15. (Original) The method of claim **14** wherein said manipulating said first design variable comprises manipulating an element of a graphical user-interface.

16. (Original) The method of claim **15** wherein said manipulating an element of a graphical user-interface comprises sliding a user-adjustable slider on a scroll-bar.

17. **(Original)** The method of claim **14** wherein said manipulating said design variable comprises entering a value for said first design variable in a text field.

18. **(Original)** The method of claim **14** wherein said manipulating said first design variable comprises specifying a probability distribution of said first design variable.

19. **(Original)** The method of claim **14** further comprising specifying a range of permissible values for said first performance attribute.

20. **(Original)** The method of claim **14** further comprising assigning a weight to said first performance attribute, thereby indicating an importance of said selected performance attribute relative to said second performance attribute.

21. **(Original)** The method of claim **19** further comprising specifying a probability distribution associated with said first performance attribute.

22. **(Original)** The method of claim **14** further comprising disposing said plurality of control graphs in an array.

23. **(Original)** The method of claim **14** further comprising disposing said plurality of control graphs in a rectangular array of rows and columns, each row being associated with a performance attribute and each column being associated with a design variable.

24. **(Original)** The method of claim **14** further comprising displaying, on said at least one control graph, an indication of allowable values of said first design variable.

25. **(Original)** The method of claim **14** further comprising displaying, on said at least one performance graph, a region of permissible values for said first and second performance attributes.

26. **(Original)** The method of claim **14** further comprising displaying, on said at least one performance graph, a region of permissible values for said first and second performance attributes, said region having a boundary representative of a Pareto optimal set of permissible values of said first and second performance attributes.

27. (Original) A computer-readable medium having encoded thereon software for visualizing the effect of selected values of a plurality of design variables on a plurality of performance attributes, said software comprising instructions for:

displaying a plurality of control graphs, at least one of said control graphs illustrating an effect of a first design variable on a first performance attribute;

displaying a plurality of performance graphs, at least one of said performance graphs showing a relationship between said first performance attribute and a second performance attribute;

displaying a plurality of decision graphs, at least one of said decision graphs showing a relationship between said first design variable and a second design variable;

manipulating said first design variable to control said first performance attribute; and

updating said at least one performance graph and said at least one decision graph in response to said manipulation of said first design variable.

28. (Original) The computer-readable medium of claim **27** wherein said instructions for manipulating said first design variable comprise instructions for manipulating an element of a graphical user-interface.

29. (Original) The computer-readable medium of claim **28** wherein said instructions for manipulating an element of a graphical user-interface comprise instructions for sliding a user-adjustable slider on a scroll-bar.

30. (Original) The computer-readable medium of claim **27** wherein said instructions for manipulating said design variable comprise instructions for entering a value for said first design variable in a text field.

31. (Original) The computer-readable medium of claim **27** wherein said instructions for manipulating said first design variable comprise instructions specifying, a probability distribution of said first design variable.

32. (Original) The computer-readable medium of claim **27** wherein said software further comprises instructions for specifying, a range of permissible values for said first performance attribute.

33. (Previously Presented) The computer-readable medium of claim **27** wherein said software further comprises instructions for assigning a weight to said first performance attribute, thereby indicating an importance of said selected performance attribute relative to said second performance attribute.

34. (Original) The computer-readable medium of claim **32** wherein said software further comprises instructions for specifying a probability distribution associated with said first performance attribute.

35. (Original) The computer-readable medium of claim **27** wherein said software further comprises instructions for disposing said plurality of control graphs in an array.

36. (Original) The computer-readable medium of claim **27** wherein said software further comprises instructions for disposing said plurality of control graphs in a rectangular array of rows and columns, each row being associated with a performance attribute and each column being associated with a design variable.

37. (Original) The computer-readable medium of claim **27** wherein said software further comprises instructions for displaying, on said at least one control graph, an indication of allowable values of said first design variable.

38. (Original) The computer-readable medium of claim **27** wherein said software further comprises instructions for displaying, on said at least one performance graph, a region of permissible values for said first and second performance attributes.

39. (Original) The computer-readable medium of claim **27** further comprising instructions for displaying, on said at least one performance graph, a region of permissible values for said first and second performance attributes, said region having a boundary representative of a Pareto optimal set of permissible values of said first and second performance attributes.